INTRAOCULAR LENS INJECTOR

This application is a divisional application of Ser. No. 08/086,939, filed on Jul. 2, 1993 now U.S. Pat. No. 5,468,246.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of intraocular lens replacement and, more particularly, to the insertion of an artificial intraocular lens into the eye.

2. Description of the Related Art

Artificial intraocular lenses, used to replace damaged or diseased natural lenses in the eye, have been widely accepted in the last several decades. Typically, such intraocular lenses comprise some type of optical element and a support, or haptic, coupled thereto for properly positioning and centering the intraocular lens within the eye. Many such lenses are made from polymethylmethacrylate (PMMA), a hard plastic composition. A more recent development in the field of intraocular lenses is the use of a soft, biocompatible material, such as silicone, to manufacture the lenses. Silicone lenses have the advantage of being lighter in situ than PMMA lenses, and because they are flexible, they can be folded to reduce their size during implantation into the eye in accordance with conventional surgical procedures.

A technique which has gained wide acceptance for the removal of the diseased or damaged native lens is called phacoemulsification. The phacoemulsification process is very advantageous because of the extremely small incision required to perform the technique. The incision can be as small as 2–4 millimeters in length. Several prior art attempts have been made to form an intraocular lens injector that would enable the insertion of an intraocular lens through the small phacoemulsification incision without requiring the elongation of the incision.

U.S. Pat. No. 4,681,102 issued on Jul. 21, 1987 to Michael T. Bartell discloses an apparatus and method for the insertion of an intraocular lens through a small incision on the order of several millimeters. The insertion apparatus disclosed by Bartell comprises a load chamber which is utilized to fold a soft intraocular lens into a shape which has a smaller cross-sectional area. The load chamber is comprised of two hinged members which together define a generally cylindrical lumen. Each of the two members includes a flange which extends non-parallel to the cylindrical members at the point of connection and enables manipulation of the cylindrical members from a first open position to a second closed position. The intraocular lens is inserted into the load chamber when the two members are in an open position. The flanges are advanced towards each other causing the two members to form the generally cylindrical chamber. As the two members advance towards each other, the intraocular lens which is inserted in the chamber is compressed in order to conform to the generally cylindrical shape of the members in the closed position.

The loading chamber, as defined above, is placed into an injector portion. The injector portion comprises an insertion cone at one end of the injector portion and a plunger at the other end of the injector portion. The plunger means presses the intraocular lens out of the generally circular lumen of the loading chamber and into the insertion cone. The intraocular lens is further compressed to a smaller diameter by the insertion cone and eventually exits a small tube of an approximately 3 mm diameter at the end of the insertion cone. In use, the Bartell lens injector is positioned such that the tube at the end of the insertion cone is inserted into the small incision made in the eye for the phacoemulsification procedure. Thus, when the lens is pushed out of the insertion cone by the plunger, the lens will be expelled into the interior chamber of the eye.

One disadvantage of the Bartell lens injector is the damage that it often causes to the lens as it is being inserted into the patient's eye. There are two areas of the Bartell injector which have a potential for inflicting damage to the intraocular lens. The first area is the loading chamber. When the lens is inserted in the loading chamber and the two semicircular members are advanced towards each other using the flanges, often the lens does not fold into the cylindrical shape as it was intended. When this occurs, a portion of the lens or the radially extending haptics becomes caught between the flanges and the lens is cut or otherwise damaged. The second area of the Bartell injector which often causes damage is the insertion cone. If the loading chamber is not properly aligned with the insertion cone the lens may be damaged when it is compressed into the insertion cone and may catch on the misaligned components. The main problem with lens damage by a lens injector is that the damage is not always detectable before the lens is inserted into the patient's eye. Once a damaged lens has been inserted into the eye, it is difficult to remove without causing damage to the surrounding eye tissue.

U.S. Pat. No. 4,702,244 entitled "Surgical Device for Implantation of a Deformable Intraocular Lens" issued on Oct. 27, 1987 to Mazzocco discloses another type of surgical device for implantation of an artificial intraocular lens in an eye through a relatively small incision. The device disclosed by Mazzocco includes a chamber for containing the intraocular lens in an unstressed state and for orienting the lens in a prescribed orientation to facilitate lens placement within the eye. The surgical device includes a means for exerting a force on the lens sufficient to deform the lens such that the optical zone is deformed to a substantially smaller cross-sectional diameter than the optical zone in an unstressed state and a means to expel the lens from the device for placement in the eye. The surgical device disclosed by Mazzocco requires the use of an outside force, such as a hydraulic force or a pneumatic force, to force the lens from its unstressed state into a deformed position to enable insertion through the small incision. In the embodiment which compresses the lens from an unstressed state to a stressed state, the lens is propelled toward a small opening at the end of a holding tube. As the lens approaches the opening it is folded back against itself and compressed to fit through the opening. This device is not preferred by doctors because the deformation of the lens is not uniform throughout the lens and is not consistent with every injection. The deformation of the lens varies each time depending on what portion of the lens approaches the opening first.

Another device disclosed in the Mazzocco patent requires the stretching of the lens via two hook members which stretch the lens longitudinally before insertion in the eye. This longitudinal stretching of the lens against the two hook members also may result in damage to the lens at the location where the hook members engage the lens.

Therefore, there exists a need in the prior art for an intraocular lens injector which does not require the use of a hydraulic or pneumatic force to deform the lens. Further, there exists a need for an intraocular lens injector which can compress the lens into a smaller diameter using a mechanical force without causing any damage to the lens.

SUMMARY OF THE INVENTION

The intraocular lens injector of the present invention compresses the diameter of the intraocular lens by rolling